We Claim:

1. A method of transmitting data over a wireless communication channel, wherein data are to be embodied in at least one signal distributed over plural transmit antennas, or over plural time intervals, or both, according to a space-time matrix, the method comprising:

mapping a block of data to a sequence of symbols, each symbol having a scalar value;

defining each element of the space-time matrix as a weighted sum of symbols, wherein weights are assigned to each symbol according to a respective dispersion matrix for that symbol, the dispersion matrices do not lead to an orthogonal design, and at least one dispersion matrix is effective for distributing its associated symbol over two or more transmit antennas; and

transmitting a signal according to the space-time matrix.

2. The method of claim 1, wherein the symbols are selected from a symbol constellation.

3. The method of claim 1, wherein the sequence of symbols comprises complex-valued symbols selected from a constellation and further comprises the complex conjugates of the selected symbols.

4. The method of claim 1, wherein the sequence of symbols comprises real numbers whose amplitudes equal the real parts of elements selected from a constellation, and imaginary numbers whose amplitudes equal the imaginary parts of the selected constellation elements.

5. The method of claim 1, wherein the dispersion matrices are determined by an optimization procedure directed at making the most efficient use of the channel capacity.

6. The method of claim 1, wherein the dispersion matrices are determined by an optimization procedure that seeks to maximize a measure of mutual information between transmitted and received signals.

7. The method of claim 6, wherein the measure of mutual information is derived, in part, from an effective channel matrix $\tilde{H}$ that linearly relates a vector $\tilde{s}$ of real and imaginary parts of selected symbols to a vector $\tilde{x}$ of real and imaginary parts of signals received due to transmission of the selected symbols, the linear relationship having the form $\tilde{x} =$ (normalizing factor) $\times$ $\tilde{H}\tilde{s}$ + (additive noise vector).

8. The method of claim 7, wherein the measure of mutual information is proportional to a statistical expected value of $\log\det(I_{2NT} + \frac{\rho}{M}\tilde{H}\tilde{H}^T)$, wherein M is the number of transmit antennas, there are N receiving antennas, there is a measured signal-to-noise ratio of ρ, the signal to be transmitted is distributed over T time intervals, I_{2NT} is the identity matrix of dimension $2NT$, and $\tilde{H}^T$ is the conjugate transpose of $\tilde{H}$.

9. The method of claim 6, wherein the measure of mutual information is derived from an effective channel matrix $\tilde{H}$, each element of $\tilde{H}$ is a weighted sum of real and imaginary parts of measured channel coefficients, and in each said element, the weights are real and imaginary parts of elements of dispersion matrices.

10. The method of claim 9, wherein the measure of mutual information is proportional to a statistical expected value of $\log\det(I_{2NT} + \frac{\rho}{M}\tilde{H}\tilde{H}^T)$, wherein M is the number of transmit antennas, there are N receiving antennas, there is a measured signal-to-noise ratio of ρ, the signal to be transmitted is distributed over T time intervals, I_{2NT} is the identity matrix of dimension $2NT$, and $\tilde{H}^T$ is the conjugate transpose of $\tilde{H}$.

11. A method of recovering data transmitted over a wireless communication channel in the form of at least one signal distributed over plural transmit antennas, or over plural time intervals, or both, according to a space-time matrix whose rows or columns correspond to transmit antennas, the method comprising:

receiving a signal amplitude from each of a plurality of receiving antennas, or in each of a plurality of time intervals, or both; and

solving a set of linear equations or operating a maximum-likelihood detector, thereby to obtain from the received amplitudes the values of a plurality of symbols, each symbol a complex scalar selected from a constellation for transmission, wherein:

the solving step utilizes known values of dispersion matrices;

each selected symbol, its complex conjugate, or at least its real or imaginary part, is distributed over the space-time matrix with weights determined by one of the dispersion matrices;

at least one dispersion matrix is effective for distributing its associated symbol over two or more rows or columns of the space-time matrix, whichever correspond to transmit antennas; and

the dispersion matrices do not lead to an orthogonal design.

12. The method of claim 11, wherein the solving step utilizes an effective channel matrix $\tilde{H}$, each element of $\tilde{H}$ is a weighted sum of real and imaginary parts of measured channel coefficients, and in each said element, the weights are real and imaginary parts of elements of dispersion matrices.

13. The method of claim 12, wherein the dispersion matrices are designed to maximize a quantity proportional to a statistical expected value of

$\log\det(I_{2NT} + \frac{\rho}{M}\tilde{H}\tilde{H}^T)$, wherein M is the number of transmit antennas, there are N receiving antennas, there is a measured signal-to-noise ratio of ρ, the signal to be transmitted is distributed over T time intervals, I_{2NT} is the identity matrix of dimension $2NT$, and $\tilde{H}^T$ is the conjugate transpose of $\tilde{H}$.

14. The method of claim 11, wherein the dispersion matrices are determined by an optimization procedure directed at making the most efficient use of the channel capacity.